MATH 120 2016-2 Recitation Problems for Week 5

1. Find an equation of the set of all points equidistant from the points $A(-1,5,3)$ and $B(6,2,-2)$. Describe and sketch the set.

2. Describe (and sketch if possible) the set of points in $\mathbb{R}^3$.

$$(a)\quad |z| \leq 2 \quad (b)\quad x^2+z^2 \leq 4 \quad (c)\quad xy=0 \quad (d)\quad xyz=0 \quad (e)\quad 1 \leq x^2+y^2+z^2 \leq 25$$

3. For given $\mathbf{a} = \mathbf{i} + \mathbf{j} + \mathbf{k} \quad \mathbf{b} = \mathbf{2i} - \mathbf{j} + \mathbf{3k}$, evaluate the followings:
   (a) $|\mathbf{a}|$
   (b) $2\mathbf{a} - \mathbf{3b}$
   (c) unit vectors, in the direction of $\mathbf{a}$ and $\mathbf{b}$
   (d) $\mathbf{a} \cdot \mathbf{b}$
   (e) the angle between $\mathbf{a}$ and $\mathbf{b}$
   (f) the scalar projection of $\mathbf{a}$ in the direction of $\mathbf{b}$
   (g) the vector projection of $\mathbf{b}$ along $\mathbf{a}$.

4. Find the values of x such that the given vectors $\mathbf{a} = \mathbf{xi} + \mathbf{j} + \mathbf{2k}$ and $\mathbf{b} = \mathbf{3i} + \mathbf{4j} + \mathbf{xk}$ are orthogonal.

5. A line l is given as intersection of two planes

$$\begin{cases} x - 2y + 3z &= 0 \\ 2x + 3y - 4z &= 0 \end{cases}$$

   a. find an equation of the line in the parametric form;
   b. find a point on the line l closest to the point $(1,2,3)$.

6. Determine if there exists a plane that containing points $(2,0,3)$, $(3,2,-1)$ and a line

$$\frac{x-3}{4} = \frac{y-1}{8} = \frac{z+2}{-3}.$$

7. **a.** Determine if a given lines are parallel, intersecting or skew

$$\frac{x-1}{2} = \frac{y-1}{5} = \frac{z+1}{-5} \quad \text{and} \quad \frac{x-1}{4} = \frac{y-5}{5} = \frac{z-2}{7}$$

   b. Determine values of l and m, if exists, for which the following pair of planes

$$2x + ly + 3z = 5 \quad \text{and} \quad mx - 6y - 6z + 2 = 0$$

   is parallel, perpendicular, intersect at $\frac{\pi}{7}$ angle.

8. Describe and sketch the geometric object represented by the system of equations.

$$\begin{cases} x^2 - 4y^2 - 16z^2 &= 16 \\ 3x - 21 &= 0 \end{cases}$$

9. Sketch the graph of the surface

$$x^2 - cy^2 + z^2 = 1$$

   depending on the value of c.